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**THE USE OF THREE-DIMENSIONAL
IMAGES IN STAGE ART**

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The purpose of the scientific paper is to clarify the features of the three-dimensional image and the possibility of its use in the stage space. The research methods. In this scientific paper the general scientific and specific scientific methods are used: analytical – in the analysis of philosophical, art studies, cultural literature on the subject of research; historical – in consideration of the stages of the formation of video mapping as an artistic phenomenon; theoretical – to clarify the essence of the concept of “video mapping”, its components and the specifics of bringing it to the stage space; comparative-typological – to reveal features of similarity and differences between scenic and visual arts; conceptual – in the characterization of the conceptual-terminological research system. The scientific novelty of the work lies in the fact that for the first time it has revealed the possibility of using a three-dimensional image in the production process of entertaining and spectacular events and the relevant problems with its practical implementation in the stage space have been analyzed.

Conclusions. On the material of theatrical and variety productions, fashion shows and concert items, it is proved that the use of the technical component of video mapping is possible in the conditions of the stage space; it visually gives the stage special expressiveness, it can serve as a stage decoration equipment and create an impressive effect of illusion and entertainment.

Keywords: video mapping; projection; stage space; stage art.

Introduction

The appearance of a three-dimensional image marked a new stage in the development of not only screen-oriented types of art (television, cinema, video), but also visual and spatial ones. Today, a three-dimensional stereo image is obtained from the category of “curiosity”, and it is often used in everyday life: in the process of creating promotional presentations, while watching movies, videos, playing video games, in creating art objects, and the like.

In one of the first scientific reports on the three-dimensional image “A Vision of Telepresence for Medical Consultation and Other Applications” H. Fuchs at the International Symposium on Robotics Research in 1993 proposed a new model of projecting an image onto a non-flat surface.

Modern scientists have begun to thoroughly explore the features of 3d-projection and its influence on the consumer audience. Thus, creative developers in the field of information science from Microsoft Reseach B. Jones, H. Benko, E. Ofek, A. Wilson in the article “IllumiRoom: Peripheral Projected Reality with the Beamatron” (2013), analyzing 3d-specificity, note that the stereo image greatly improves the impression of viewing the projected images. Researchers B. Buxton (“Interfaces for multiparty videoconferences”, 1997) and O. Bimber (“Superimposing pictorial artwork with projected imagery”, 2006) interpret the artistic component of the three-dimensional image. O. Bimber, through the example of the synthesis of works of pictorial art of computer interactive technologies, justified the expediency of using such a synthesis; the scientist emphasizes that with the help of the newest technologies, in particular video mapping, we can take a fresh look at the original artifacts. Authors R. Raskar, G. Welch, M. Cutts, A. Lake, L. Stesin, and H. Fuchs in the research paper “The Unified Approach to Image-Based Modeling and Spatially Immersive Displays” (1998) suggested a hypothesis: the projection could cover any surface, and “announced” the appearance of the first 3D scanner model (Kinect). However, despite public attention to the 3d-imagery, there is not enough scientific substantiation of the possibility of using three-dimensional images in art, identifying artifacts that could explain the emergence of new visual art directions based on three-dimensional stereo images.

The purpose of the article

The research purpose is to identify the features of the three-dimensional image and the likelihood of its use in the stage space, to find out the concept of “video mapping”, “stage space” and “projection”, “visual art”, etc., to reveal the specifics of projecting onto a non-flat surface.

Presentation of the main material

The use of the projection of a three-dimensional image in the conditions of stage space is often called “video mapping”, “spatial expansion of reality”.

Video mapping (*Eng.* video – video, television; mapping - charting, imaging) – a term that appeared in the USA in the middle of the twentieth century. It means three-dimensional projection of images onto physical objects taking into account geometry and position in space.

The first attempt at projecting onto non-flat surfaces took place in 1969 during the opening season of the Haunted Mansion in Disneyland. The marble busts of the characters of that spectacular performance, which, with the help of images of people projected on them, “came to life” and began to sing “Grim Grinning Ghosts”, became the surfaces for projection. This optical illusion of “singing” marble busts testified to the appearance of a new visual direction of the “spatial expansion of reality” (see Figure 1).



Figure 1. Projection of marble busts on the opening season of the Haunted Mansion in Disneyland (1969)

Much later, in 1991, Walt Disney Co patented an invention called “An apparatus and method for projection upon a three-dimensional object”. The document describes a system for digital image processing on the “reverse three-dimensional object” (see Figure 2).

Let us consider the characteristics of the patent:

“A projection apparatus and method for vivid and realistic projection is disclosed, with applications to amusement and optical engineering. Contemplated applications of the invention also include video shopping applications and cosmetic applications. Graphics data is entered into a user interface and is processed to generate an output representing an image to be projected onto a three-dimensional object.

The projected image may be interactively modified and it may also be stored in memory and projected as part of an image sequence so as to create apparent motion in the object.”

Draw attention to the last sentence in the context of the characteristics of the patent. We focus on the fact that we are not talking about the projection of previously prepared video material onto a non-flat three-dimensional surface, but about the possibility of interactively, physically changing the information and visual imagery of the projection. So, video mapping goes into the category of innovative interactive visual phenomena.

In 1994, General Electric Co registered another patent for the invention “A system and method for precisely superimposing images of computer models in three-dimensional space to a corresponding physical object in physical space”, supplementing the first one (the patent “An apparatus and method for projection upon a three-dimensional object” from Walt Disney Co).

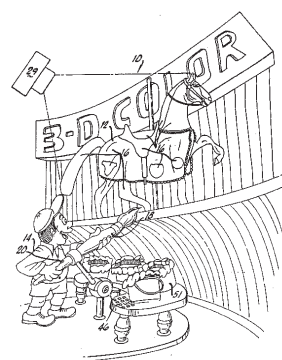


Figure 2. The scheme of projection of the image according to the patent “An apparatus and method for projection upon a three-dimensional object” (1991)

Here is a fragment of this patent: “A system and method for precisely superimposing images of computer models in three-dimensional space to a corresponding physical object in physical space. The system includes a computer for producing a computer model of a three-dimensional object. A projector means projects an image of the computer model onto the physical object. A spatial transformation accurately maps the computer model onto a projection stage at the projector which projects a formed image in a three-dimensional space onto the physical object in a one-to-one correspondence.”

These publications allowed many specialists in the computer, medical and even artistic industries to develop the concept of using three-dimensional projection.

Now, generally, three-dimensional video mapping is used to transmit a projection show on the facades of buildings, screens and in other planes – not always flat and one-dimensional – for which an individual video sequence is created for each facade of the building, with the aim to “use to the best effect” and emphasize the architectural details of the structure. This type of video mapping in accordance with the specifics of the application is called “architectural video mapping”. Masters of architectural video mapping create impressive visual illusion images of the dynamic geometry of space and amazing pictures.

One of the first projections targeted at the building was a spectacular original three-dimensional video installation created for the presentation of Samsung 3d LED TVs (2011), which was shown onto the historical building of the Beurs van Berlage Stock Exchange to residents and guests of Amsterdam. Later, this technology of three-dimensional projection was transferred from the category of “curiosity” to the wider and more practical use by directors of street entertainment and commercial events. An example is the opening of the Stanislavsky electro theater (Tverskaya str., Moscow, 2015).

To project onto the facade of the theater, it was necessary to place projectors in front of the building – across the road on the parallel side of the street. The distance was too long, and the illumination of one of the central streets of the city was strong for the projection of the video sequence. Taking this into account, it was necessary to install a significant number of projectors that duplicated images in the same areas of the building.

At every such performance thousands of viewers gather, who not only watch and admire it, but also record it on video cameras, then post it on the Internet, where a few more thousand people view the newly created visual phenomenon.

Video mapping and stage space. The use of three-dimensional projection technology in the stage space is a striking and extraordinary phenomenon. It can be seen at the AKHE Berlin Theater at the performance “Depot of genius delusions” (premiered in 2012). This is the case when the stage performance is completely organized involving the projection of a three-dimensional image. The platform, on which the audience is located, slowly returns. Viewers can watch the play of actors and projection video sequence that also move around them. The actors on the stage clearly know their acting areas (the exact location on the stage in relation to the viewer, actors and three-dimensional projection) and adapt to the projection of the video sequence. This stage action amazes with the interaction of the vivid cast and the projection technology of a previously recorded and reproduced video sequence.

Another example, equally impressive, is the three-day production trilogy “Blue Bird” directed by the Stanislavsky electric theater in Moscow B. Yukhananov (premiered on February 25, 2015), in which M. Meterlink’s fairy tale is intertwined with personal memories of the actors of the K. Stanislavsky theater – Alefina Konstantinova and Vladimir Korenev (see Figure 3).



Figure 3. Production Trilogy “Blue Bird” (directed by B. Yukhananov)

The projection video sequence (created by artist I. Isaev over the year) serves as a backdrop in the performance, easily changing the circumstances of the action: with the help of special effects, the viewer finds himself/herself in a winter airport, in hot Baku, under water or in the pages of Dostoevsky’s manuscript.

In addition, moving images of weightless snow or fog, water and clouds appear, enhancing the emotional coloring of the performance.

However, performances that use video mapping technology are “not mobile” (it’s extremely difficult to give performance on a tour with them) because the video sequence of mapping requires precise positioning of projectors, matching the stage platform to the audience, and a clear positioning of the acting area for the cast in accordance with the projection.

Furthermore, it is necessary to find suitable places for installation of video projectors (most often they are placed high above the audience space and projected at an angle so that the image is projected onto the audience, actors and possible decorations).

A striking example is the use of video mapping technology at a fashion show (“The 2013 Toronto Fashion Incubator Fashion Show”), where an image of a served dinner table was projected onto the entire podium plane with the use of eight projectors (see Figure 4). The implementation of this idea with the help of decorations and other attributes (live podium serving) would be extremely inconvenient and even dangerous, because models walk around the podium, and there is the audience around.



Figure 4. 3d-image projection on the show “The 2013 Toronto Fashion Incubator Fashion Show”

The next spectacular fashion show “The Official Ralph Lauren 4D Experience” (USA, New York, 2010) is striking in its originality (see Figure 5). It would seem that it was impossible to imagine the outfit without a vivid, direct work of fashion models, who solemnly and harmoniously passed through it on a spacious, illuminated podium. However, at this show, everything (the room, the scenery, the stage requisites, and even the models) is a projection onto the facade of the building – there is only an illusion of reality in everything.



Figure 5. 3d image projection on The Official Ralph Lauren 4D Experience fashion show (USA, New York, 2010)

360-degree expansion video mapping. Project *Living Room Projection by Mr. Beam* transformed the white room a 360-degree in space into several differently designed living rooms using a projection. Thanks to the new projection development, it became possible to control the light-color saturation, the conformity of patterns

and texture of furniture, wallpaper and carpets in relation to real objects. Only two projectors are involved in the project. So, video mapping can completely replace the scenery and scenographic filling of the stage space (see Figure 6).



Figure 6. Living Room Projection by Mr. Beam

The task of each scene designer is a complete immersion in the concept, a change of mood and a constant surprise of the audience.

Modern technologies make it possible to achieve the motion of the video surfaces over the whole stage space and even in the audience space in different planes with the help of tilting and sliding mechanisms, as well as dynamic winches, to unite in one plane and fall to small pieces.

Video mapping on individual objects. The performance of Jennifer Lopez with the new song “Feel the Light” on the American show “American Idol” amazed the world, not because of her voice, but the amazing technology of video mapping on the performer’s dress. The skirt of her dress was a 20-foot radius; it was used as a background for the projection of images, which contained projections of the night sky, as well as a video clip from the cartoon “Home”.

The scientific novelty of the work lies in the fact that for the first time it has revealed the possibility of using a three-dimensional image in the production process of entertaining and spectacular events and the relevant problems with its practical implementation in the stage space have been analyzed.

Conclusions

Summarizing the above, we note that in recent years, the use of video mapping can be seen anywhere: on the facades of buildings, in exhibition halls, in places of commercial trade, catering and recreation, and even in the stage space, where projected images often serve as decoration.

Any physical object (building, car, decoration, clothes, human body) can be projection objects. Video mapping is a visual direction that is developing dynamically and is quickly being modified, so further research into the development of video mapping is an urgent need, especially in the view of artistic criticism.

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ОСОБЛИВОСТІ ВИКОРИСТАННЯ ТРИВИМІРНОГО ЗОБРАЖЕННЯ В СЦЕНІЧНОМУ МИСТЕЦТВІ

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Мета роботи – з'ясування особливостей тривимірного зображення та ймовірності його використання в сценічному просторі. Методологія дослідження. У роботі застосовано загальнонаукові та конкретнонаукові методи: аналітичний – в аналізі філософської, мистецтвознавчої, культурологічної літератури з теми дослідження; історичний – у розгляді етапів становлення відеомапінгу як мистецького явища; теоретичний – для з'ясування сутності поняття «відеомапінг», його складника та специфіки залучення в сценічний простір; порівняльно-типологічний – для виявлення рис подібності й відмінності сценічного та візуального мистецтва; концептуальний – у характеристиці понятійно-термінологічної системи дослідження. Наукова новизна роботи полягає в тому, що в ній уперше виявлено можливість використання тривимірного зображення в процесі виробництва розважально-видовищних заходів та проаналізовано відповідні проблеми з його практичного впровадження в сценічний простір. Висновки. На матеріалі театральних та естрадних постановок, показів мод і концертних номерів доведено, що використання технічного складника відеомапінгу є можливим в умовах сценічного простору; він візуально надає сценічній дії особливу виразність, може слугувати декоративним обладнанням підмостків і створювати вражаючий ефект ілюзії та видовищності.

Ключові слова: відеомапінг; проєкціонування; сценічний простір; сценічне мистецтво.

**СПЕЦИФИКА ИСПОЛЬЗОВАНИЯ
ТРЕХМЕРНОГО ИЗОБРАЖЕНИЯ
В СЦЕНИЧЕСКОМ ИСКУССТВЕ**

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Цель работы – выяснение особенностей трехмерного изображения и вероятности его использования в сценическом пространстве. Методология исследования. В работе применены общенаучные и конкретнонаучные методы: аналитический – для анализа философской, искусствоведческой, культурологической литературы по теме исследования; исторический – в рассмотрении этапов становления видеомэппинга как художественного явления; теоретический – для выяснения сущности понятия «видеомэппинг», его составляющей и специфики привлечения в сценическое пространство; сравнительно-типологический – для выявления черт сходства и различия сценического и визуального искусств; концептуальный – в характеристике понятийно-терминологической системы исследования. Научная новизна работы заключается в том, что в ней впервые обнаружена возможность использования трехмерного изображения в процессе производства развлекательно-зрелищных мероприятий и проанализированы соответствующие проблемы с его практическим внедрением в сценическое пространство. Выводы. На материале театральных и эстрадных постановок, показов мод, концертных номеров доказано, что использование технической составляющей видеомэппинга возможно в условиях сценического пространства; она визуально придает сценическому действию особенную художественную выразительность, может служить декорационным оборудованием подмостков и создавать впечатляющий эффект иллюзии и зрелищности.

Ключевые слова: видеомэппинг; проектирование; сценическое пространство; сценическое искусство.